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RISDM:
A Requirements Inspection Systems Design Methodology

Perspective-Based Design of the Pragmatic Quality Model and Question Set to SRS

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Agenda

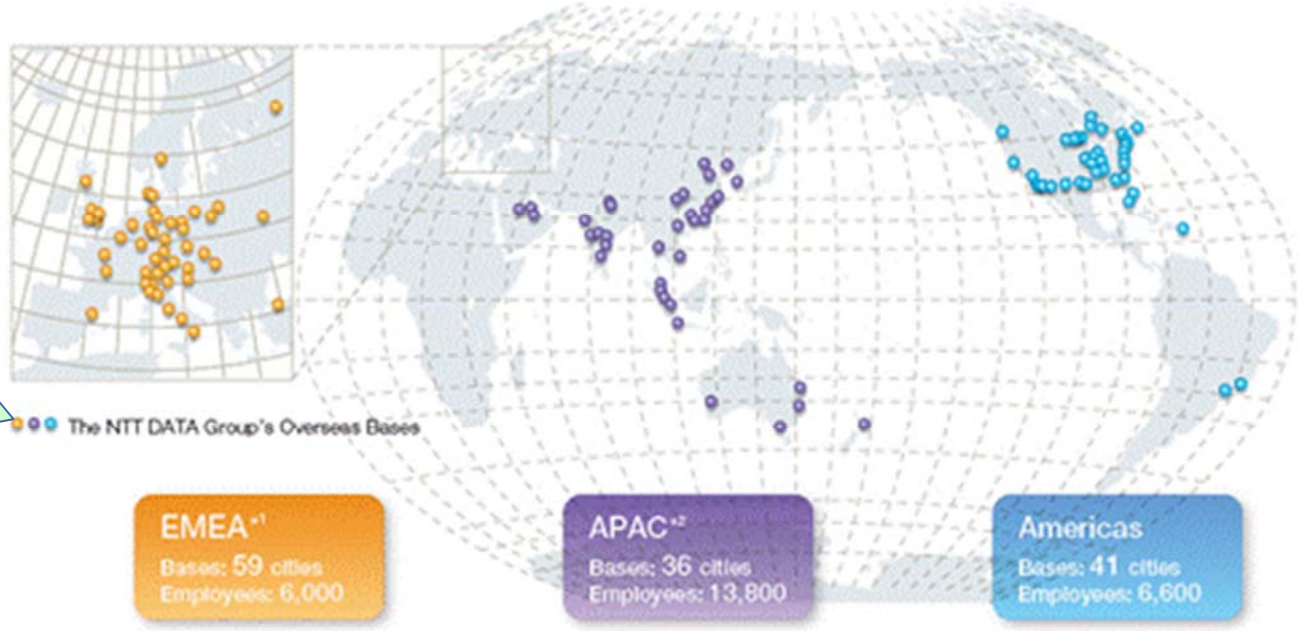
1. Background and Research Questions
2. Approach
3. Design Methodology (RISDM)
4. Practice and Evaluation
5. Conclusions and Future Works

About NTT DATA

- Our company (NTT DATA) is a global IT solution provider.

  - ✓ More than 60,000 engineers specialized in the large-scale software development.
  - ✓ The quality of the SRS (Software Requirements Specification) is the key to the success of software development.

Global NTT DATA group bases
- 175 cities in 41 countries and regions



Background

- SRS is created by the requirements engineering team.
- Software is developed by different teams (development teams).

- ✓ The development teams need to read the SRS and try to understand the customer's requirements correctly.
- ✓ To improve the quality of the SRS, review and inspection are commonly used in our company and industry in general.

However…

- ✓ Inspection highly require the inspector's skill and knowledge.
- ✓ It is difficult to assure the quality of the requirements inspection.

Necessary to develop a design methodology of requirements inspection method.

Research Questions

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- We propose RISDM (Requirements Inspection Systems Design Methodology).

  - ✓ Define a set of PQC (Pragmatic Quality Characteristic) of the SRS from a specific view points of a SRS reader.
  - ✓ Develop a reading technique for inspecting an SRS based on the PBR (Perspective Based Reading).

- We seek to answer the following research questions.

RQ1: Is the PQC designed by the RISDM useful to predict risks of the subsequent development?

RQ2: Does the reading technique designed by the RISDM help inspectors to suggest practical advices for SRS improvement?

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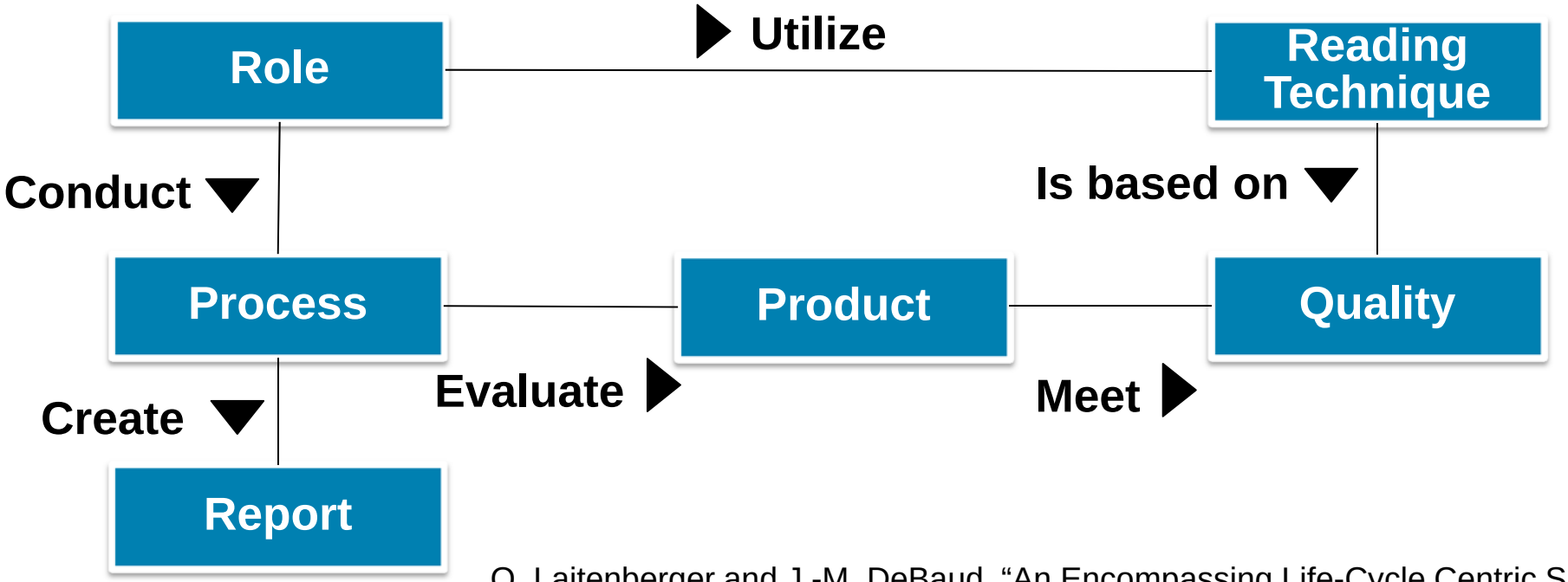
Inspection Meta-Model

- Inspection meta-model is composed of six technical components: Process, Role, Product, Quality, Reading Technique, and Report.
- Requirements inspection is a system which is a instance of the meta-model.

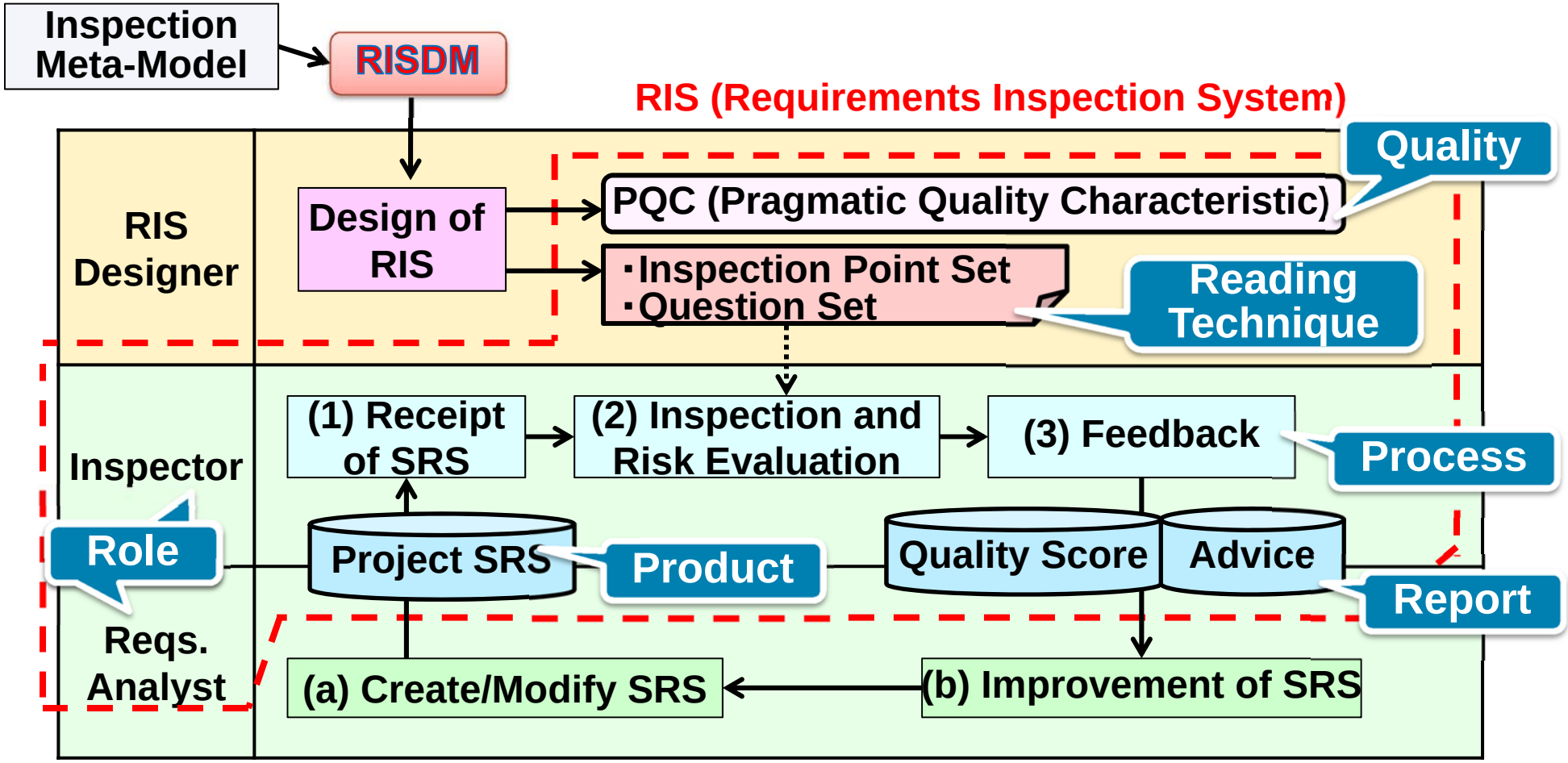
We call the system RIS (Requirements Inspection System).



O. Laitenberger and J.-M. DeBaud, "An Encompassing Life-Cycle Centric Survey of Software Inspection," J. of Systems and Software, Vol. 50, No. 1, Jan. 2000, pp. 5-31.

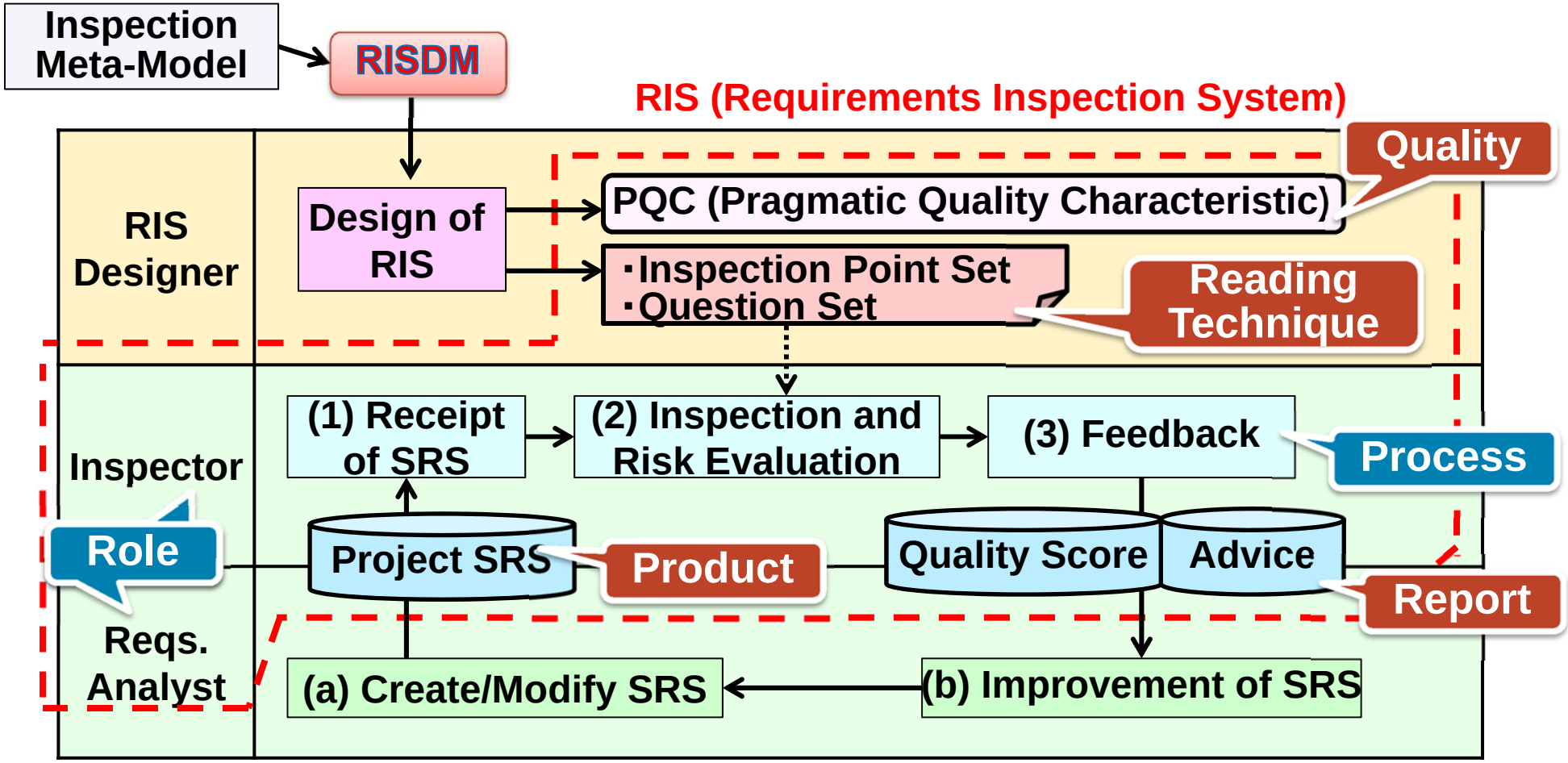
RISDM and RIS

- The RISDM is a methodology to design an RIS from the inspection meta-model.



RISDM and RIS

- Four components (Product, Quality, Reading Technique, and Report) are designed by the RISDM.



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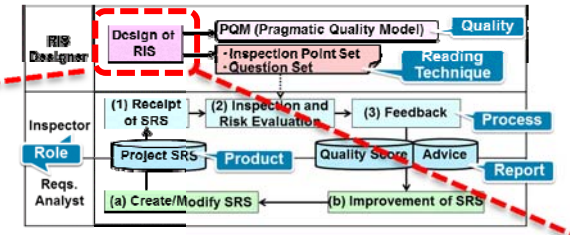
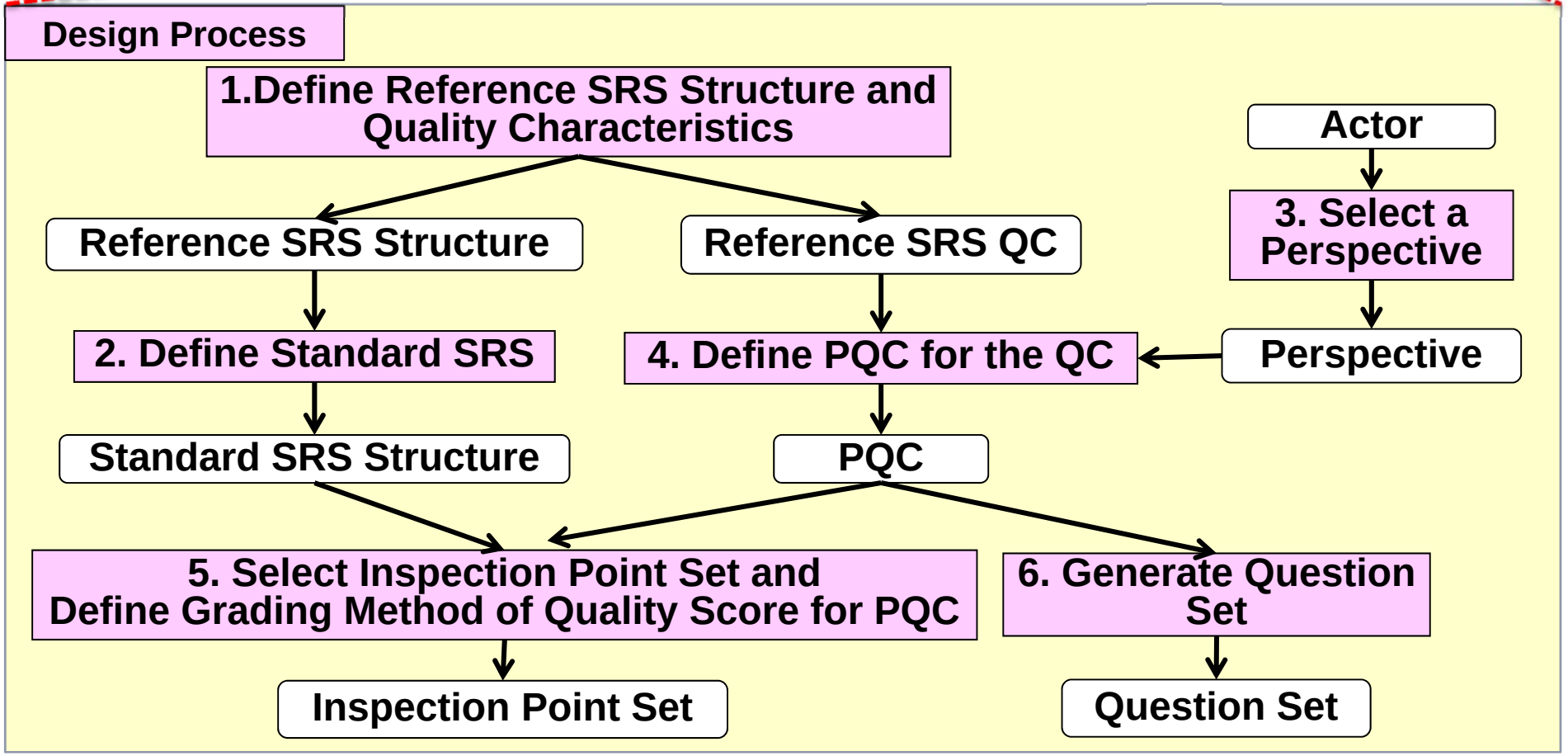
Design Process

- RISDM defines six processes for designing Product, Quality, Reading Technique, and Report.





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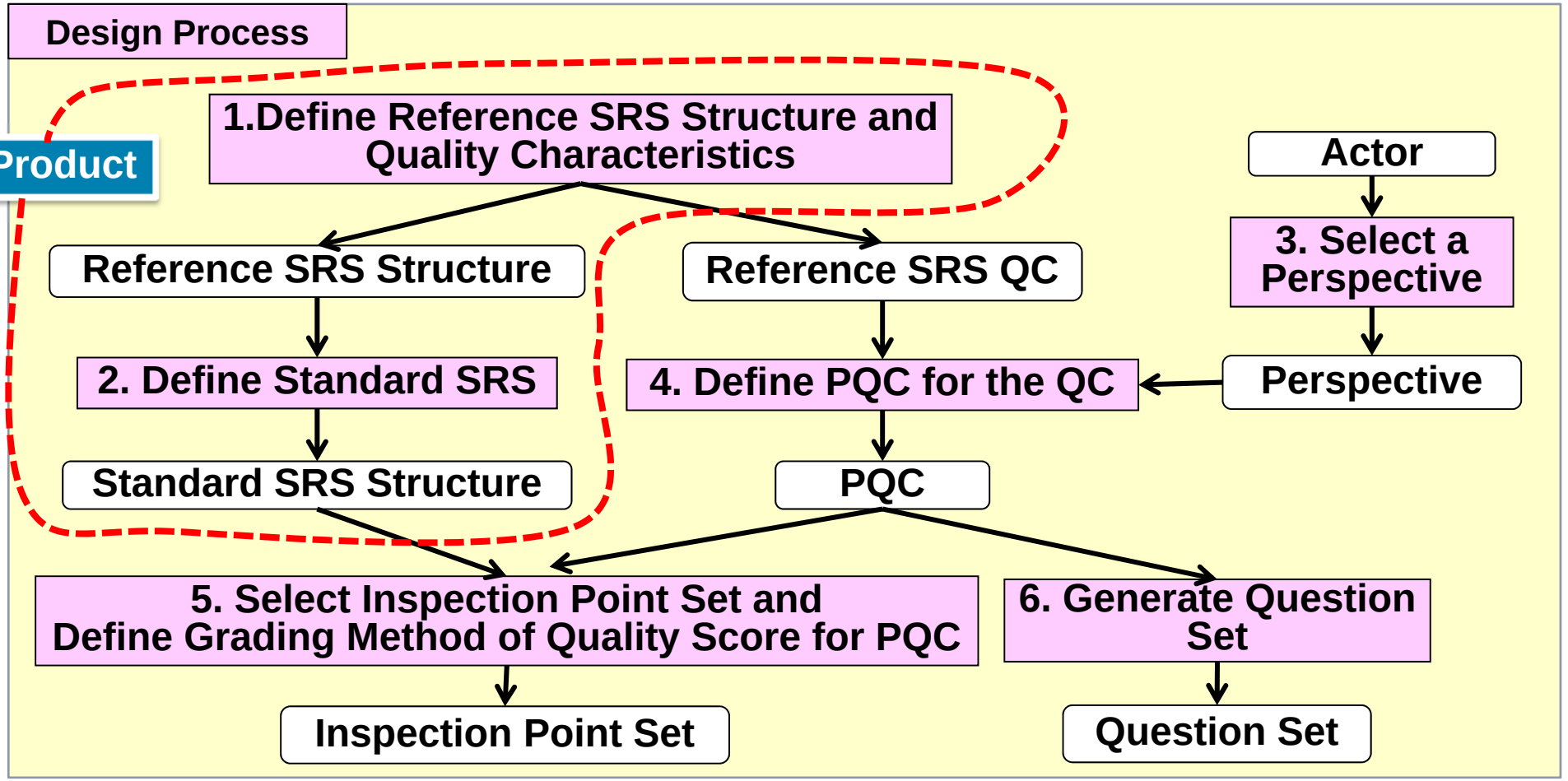


1. Define Reference SRS Structure and Quality Characteristics
2. Define Standard SRS

NTT DATA Product

- Select Reference SRS Structure and QC(Quality Characteristics) as a baseline of the RIS.
- Define the Standard SRS Structure specific to the organization.

IEEE Std. 830

Reference SRS Structure

Reference SRS QCs

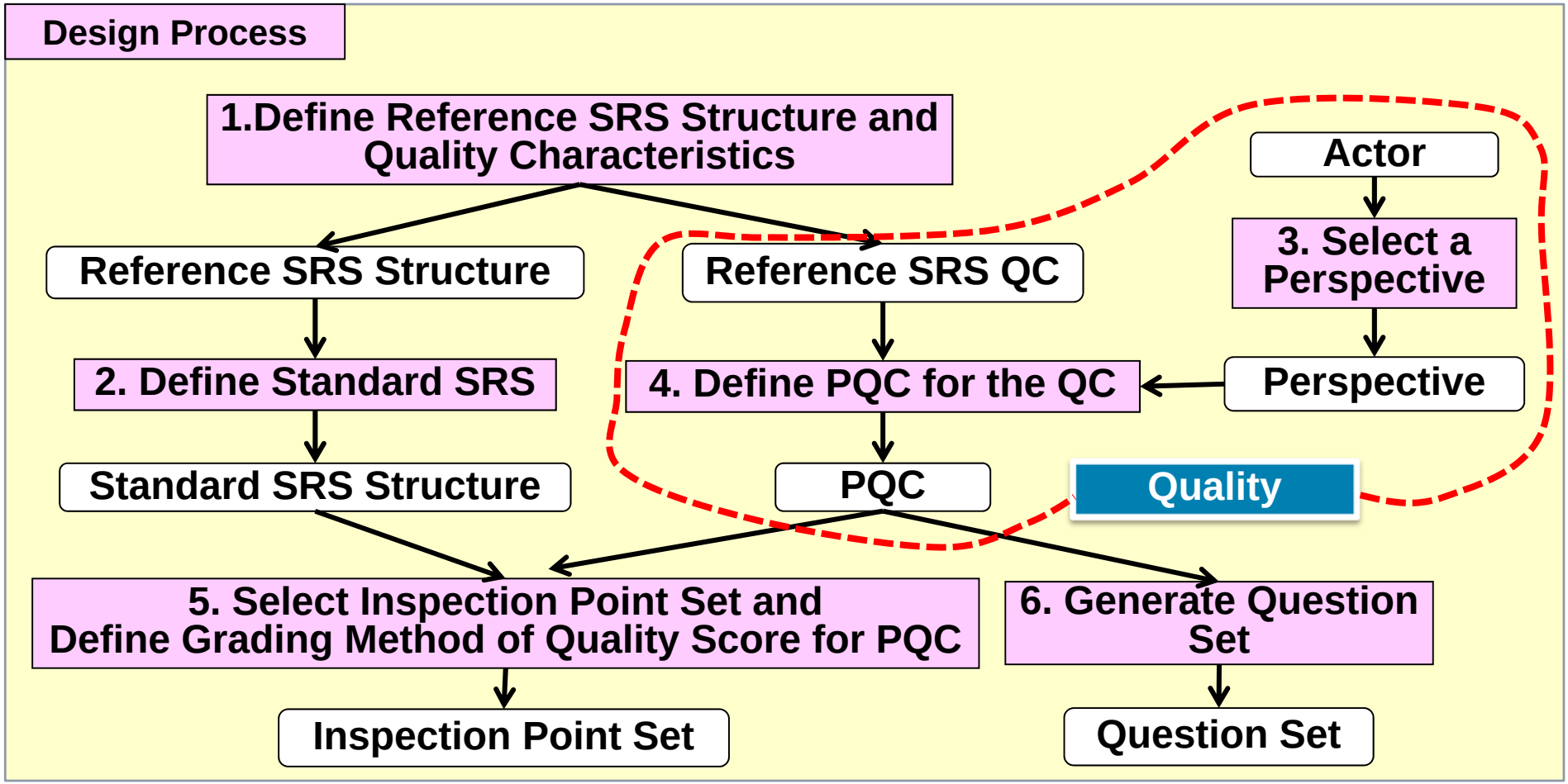
Process 4

Chapter	Section
1. Introduction	1.1. Purpose of SRS
	1.2. Intended Reader
	1.3. Structure of SRS
	1.4. References
2. Overview of System	2.1. Goal of System
	2.2. Business and Scope of System
	2.3. Constraints
	2.4. Terms
3. Items Causing Change or Unspecified	3.1. Items Causing Changes
	3.2. Items Unspecified
4. Functional Requirements	4.1. Business Flow
	4.2. Functions
	4.3. Data Model Definition
5. Non Functional Requirements	5.1. NFR Grade
	5.2. Requirements to System Architecture
	5.3. Requirements to Migration
	5.4. Requirements to Service Provisioning

Standard SRS Structure

Design Process

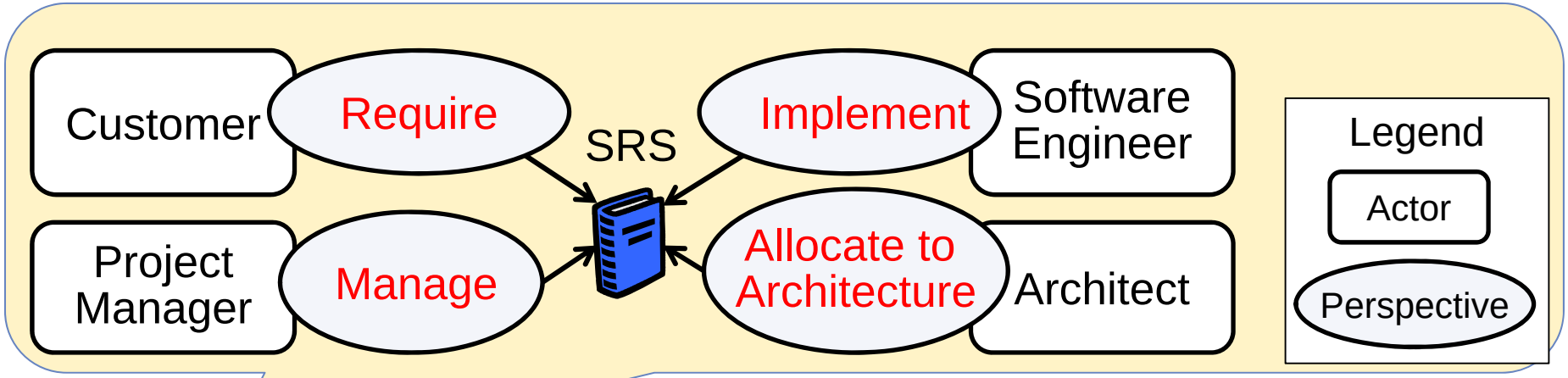
- RISDM defines six processes for designing Product, Quality, Reading Technique, and Report.



3. Select Perspective

NTT DATA Quality

- Identify actors involving to the SRS.
- Define perspectives to the SRS from the view points of the actors.



Perspective	
Level 1	**Level 2**
Require	Conform to customer's needs
Manage	Manage all elements on the progress
Implement	Design by template
	Design by standard description
	Use with common terms
Allocate to Architecture	Overview all the elements
	Specify all the elements

If necessary, the perspective identified can be decomposed into a set of detailed perspectives.

4. Define PQC for the QC

NTT DATA Quality

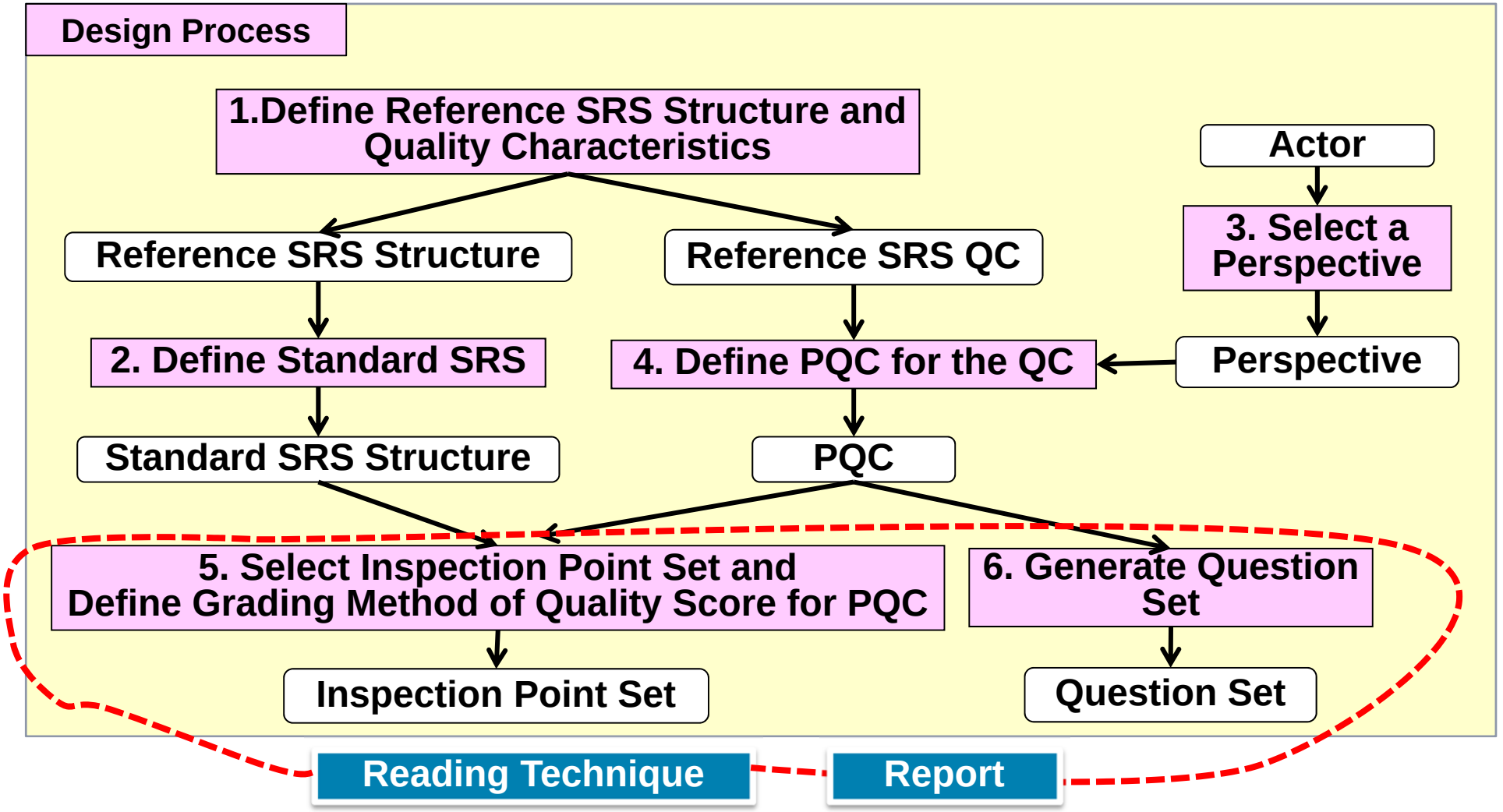
- Define PQC (Pragmatic Quality Characteristic) from the Reference QC in accordance with the perspectives.

Perspective		Reference QCs							PQCs	
Level 1	Level 2	Correct	Complete	Ranked for importance and/or stability	Unambiguous	Verifiable	Traceable	Modifiable	ID	Name
Require	**Conform to customer's needs**	X							**C1**	**Correspondence to goals**
Manage	**Manage all elements on the progress**		X	X					**C2**	**Coverability**
Implement	**Design by template**				X	X			**C3**	**Template usage**
	Design by standard description				X	X			**C4**	**Standard description usage**
	Use with common terms				X				**C5**	**Definition of terms**
Allocate to Architecture	**Overview all the elements**							X	**C6**	**Listing with identifier**
	Specify all the elements						X	X	**C7**	**Identifiability**

Refined

Design Process

- RISDM defines six processes for designing Product, Quality, Reading Technique, and Report.



5. Select Inspection Point Set and Define Grading Method of Quality Score for PQC

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Reading Technique

- Select meaningful PQCs to each element of the SRS.

Inspection Point Set

PQC		TOC of Standard SRS					
ID	Name	…	2.1 Goal of System	2.2 Business & Scope of System	2.3 Constraint	2.4 Term	…
C1	Correspondence to goals		X				
C2	Coverability		X	X	X	X	
C3	Template usage		X	X	X		
C4	Standard description usage			X			
C5	Preparation of glossary					X	
C6	Listing with identifier		X	X	X		
C7	Identifiability		X	X	X	X	

Inspection point “X” is an element of SRS where an inspection is needed.

6. Generate Question Set

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Reading Technique

- Generate a question for judging whether an SRS element meets the quality criterion in terms of the PQC.

PQC		Question Set	No. of points
ID	Name		
C1	Correspondence to goals	Are business and system requirements corresponding to the project goals?	3
C2	Coverability	Are there elements of the project SRS corresponding to the elements of the standard SRS?	54
C3	Templates usage	Are artifacts described using the template which is selected in the standard SRS?	36
C4	Standard description usage	Are artifacts described by the standard description which is selected in the standard SRS?	6
C5	Definition of terms	Are there glossaries of the project SRS created?	3
C6	Listing with identifier	Are artifacts and certain elements of the artifact given identifier and listed in the table?	48
C7	Identifiability	Are artifact and certain elements of the artifact identified using identifier?	46
		Total	196

BPMN, UML,..

Visualization of SRS Quality

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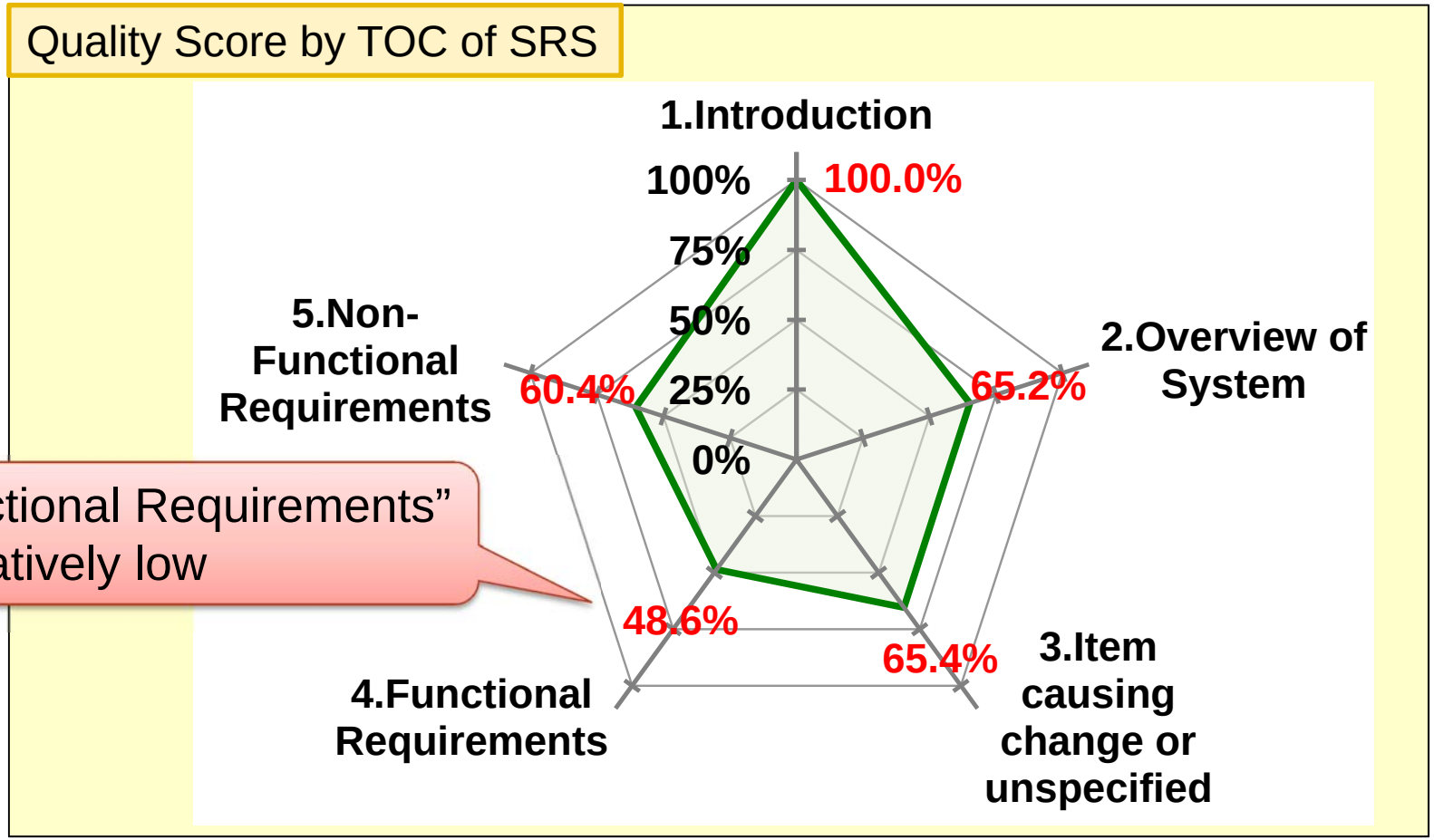
- Quality Score is calculated in percent of the total scored points.
- Inspection report shows a distribution of the quality score.
- Report indicates the strength and weakness of the SRS



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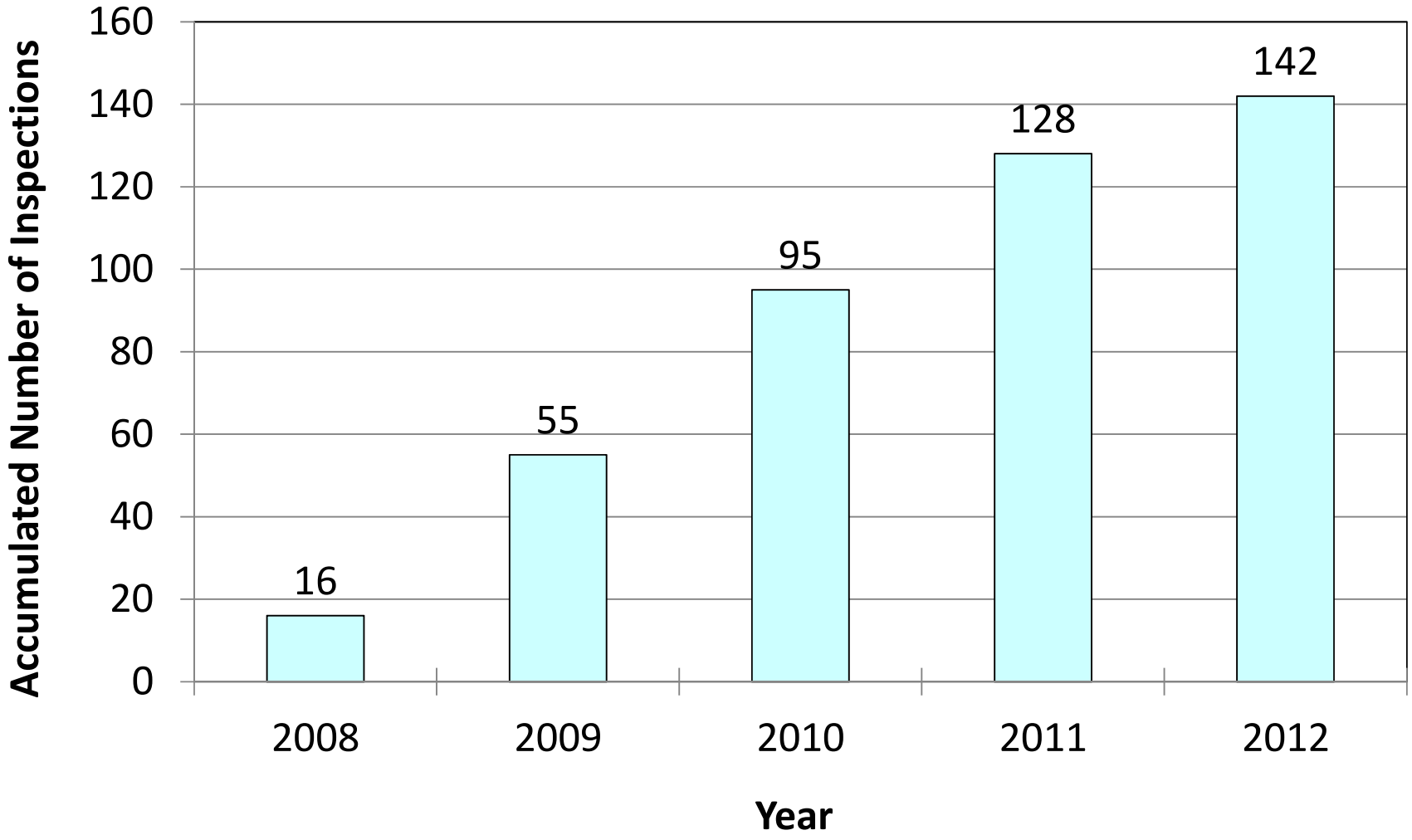
Corporate-Wide Application

- The RIS designed by the RISDM is widely used by more than 140 projects in NTT DATA.



Evaluation for Answering Research Questions

RQ1: Is the PQC designed by the RISDM useful to predict risks of the subsequent development?

A. PQC for Risk Evaluation

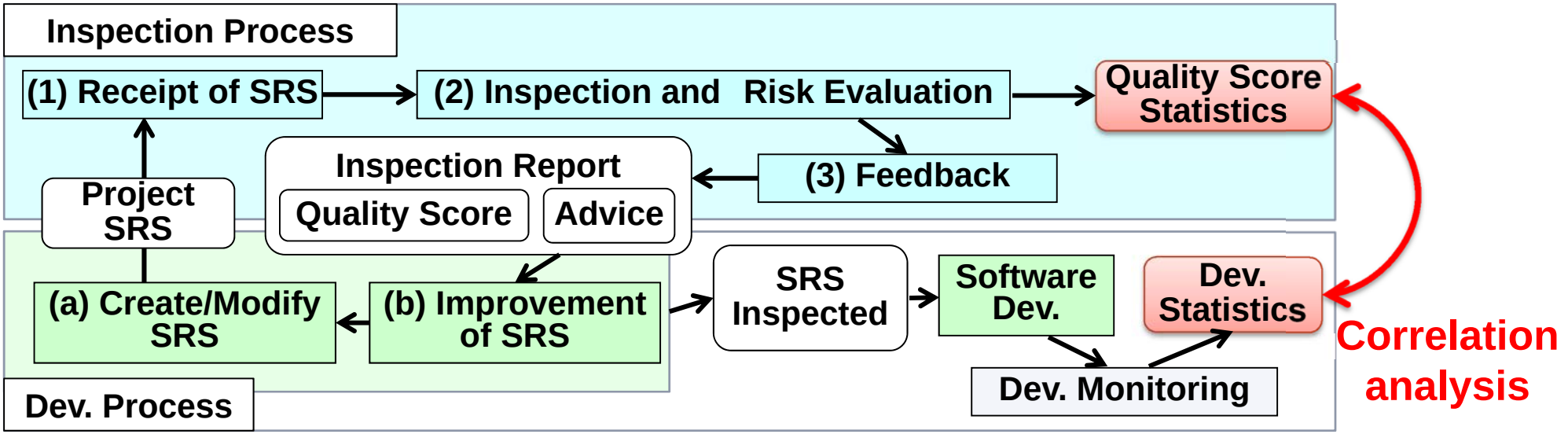
RQ2: Does the reading technique designed by the RISDM help inspectors to suggest practical advices for SRS improvement?

B. Effect of Improving the SRS by the Feedback

A. PQC for Risk Evaluation

- Purpose: To demonstrate PQC is effective to predict risks of the subsequent development.
- Method: Correlation analysis between seven QSes of PQCs and CDR (Cost Difference Ratio).

$$CDR = \frac{|\text{Actual Cost} - \text{Estimated Cost}|}{|\text{Estimated Cost}|}$$



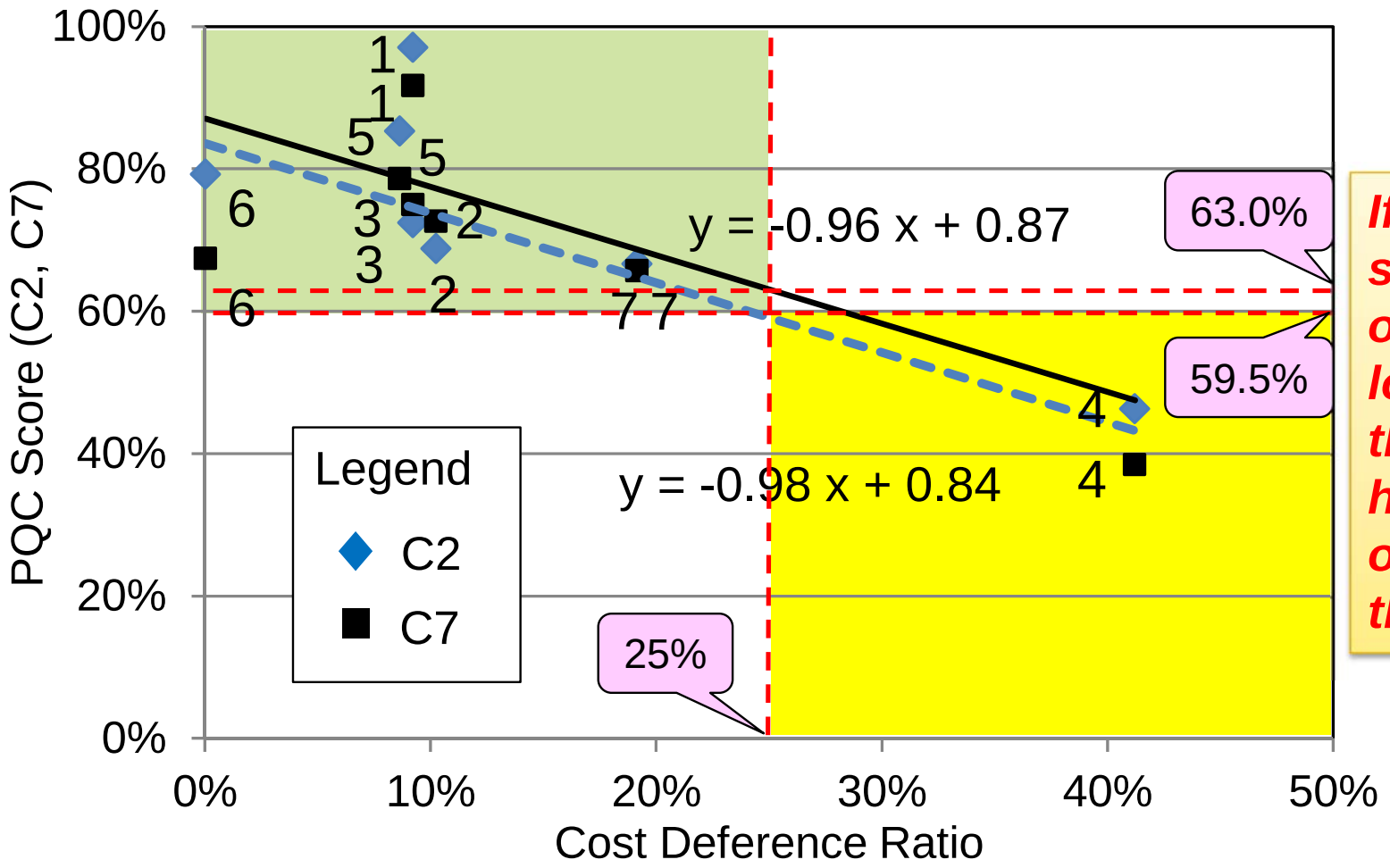
Project Profile for Analyzing Cost Overrun

- Seven projects vary in domain, development type, and size in terms of number of pages of the SRS.
- The statistics include all the elements of PQC and cost of both estimated and actual in the subsequent processes.

ID	Domain	Development Type	No. of SRS pages
1	Financial	Extension & Replacement	545
2	Public	New	401
3	Manufacturing	New	666
4	Public	New	172
5	Financial	Extension & Replacement	145
6	Distributor	New	300
7	Service	New	71

PQC Score (C2, C7) and CDR

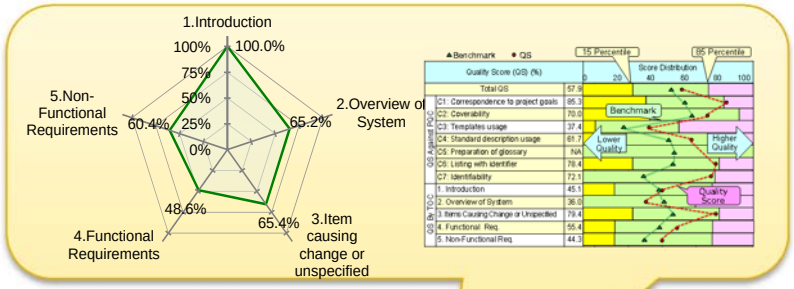
- Results: Strong negative correlation of both C2 (Coverability) and C7(Identifiability) with the CDR.

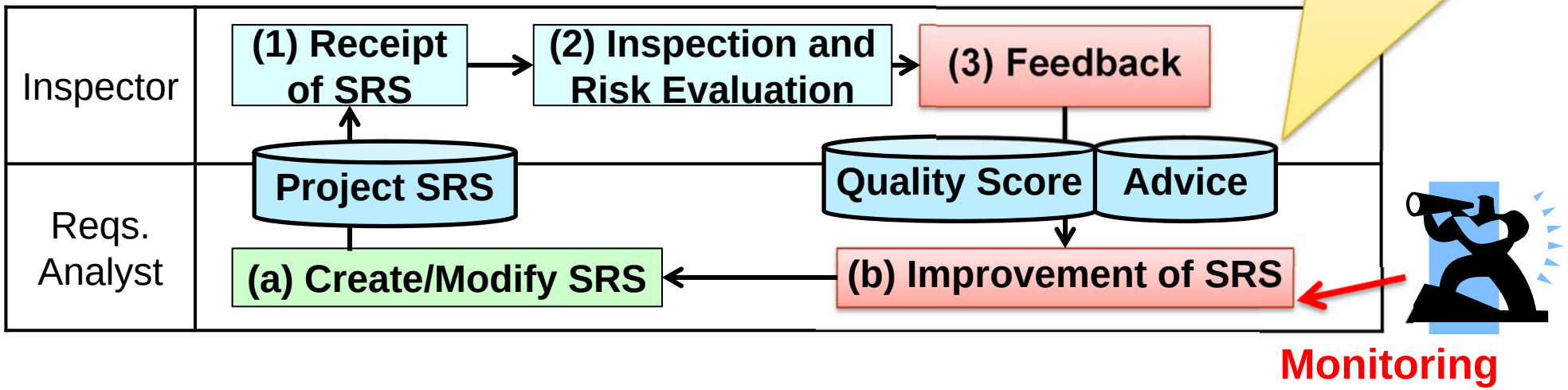


If the quality score of C2 or C7 of an SRS is lower than 60%, the project has a high risk of cost overrun by more than 25%.

B. Effect of Improving the SRS by the Feedback

- Purpose: To demonstrate how the inspection report helps requirements analysts to improve the project SRS.
- Method: Monitoring the changes of the quality scores of the SRS in terms of the PQC.





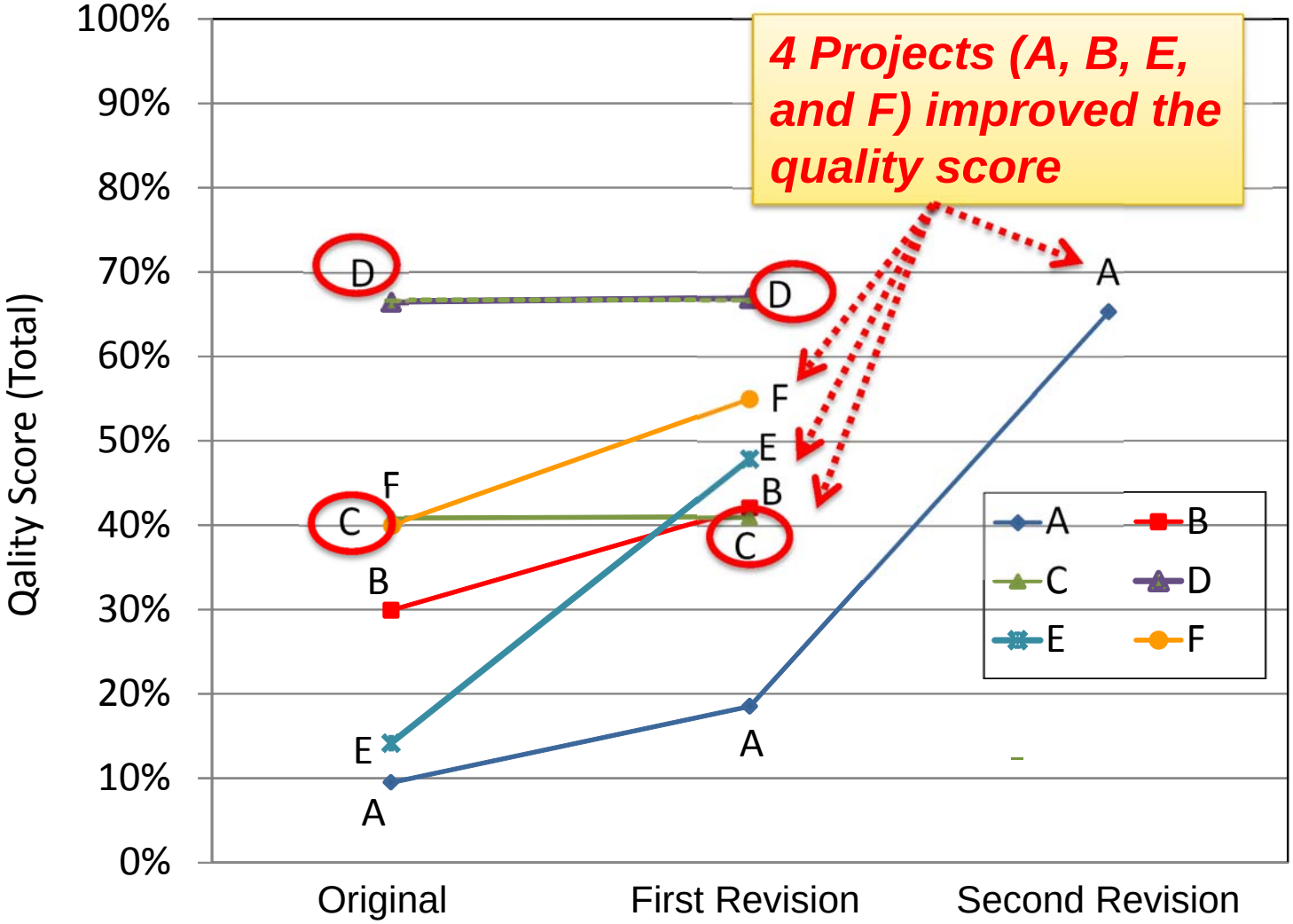
Project Profile for Analyzing PQC Improvement

- Six projects differ in the domain, development type, and size in terms of the number of SRS pages.
- We monitored the changes of the PQCs of the revised SRSes.

ID	Domain	Development Type	No. of SRS Pages
A	Financial	New	191
B	Manufacturing	New	289
C	Financial	Extension	550
D	Service	Replacement	343
E	Financial	Replacement	415
F	Financial	New	267

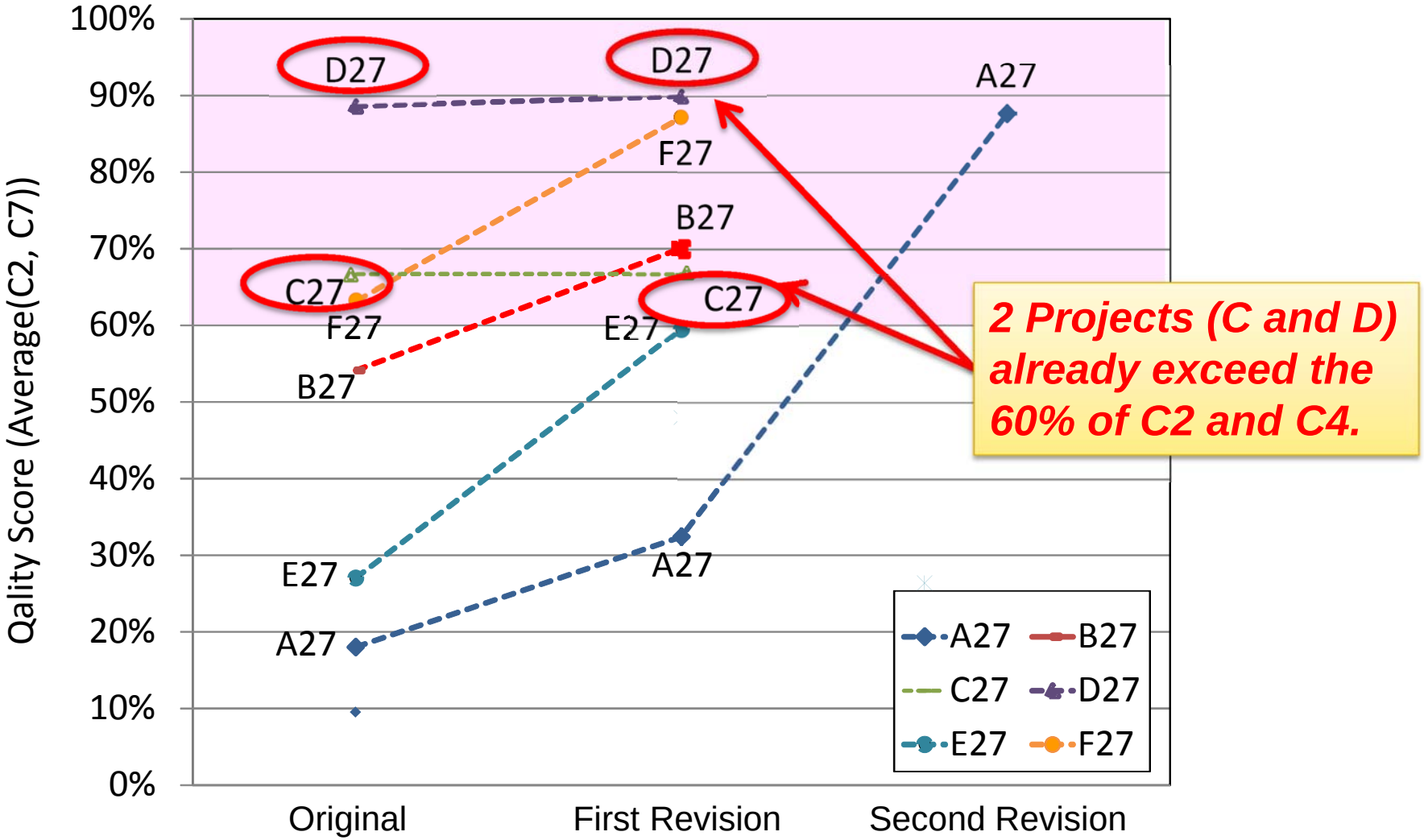
Improvement of PQC – Total Score –

- Results: 4 projects significantly improve QS. 2 projects(C, D) do not significantly improve QS.



Improvement of PQC – C2 and C7 –

- Results: All the project finally attained the average quality scores of C2(Coverability) and C7(Identifiability) over 60%.



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Answer to Research Question

RQ1: Is the PQC designed by the RISDM useful to predict risks of the subsequent development?

Yes.
We found the effectiveness of the PQC, C2 (Coverability) and C7(Identifiability), for risk prediction in terms of cost overrun.

RQ2: Does the reading technique designed by the RISDM help inspectors to suggest practical advices for SRS improvement?

Yes.
We found the effectiveness of the report for decision making of the SRS improvement.

Conclusions and Future Works

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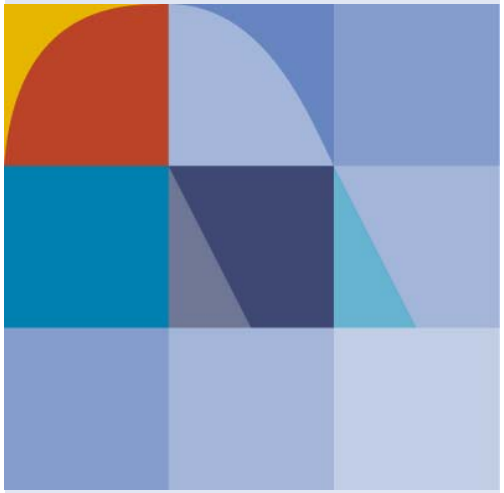
☐Conclusions

- ✓ Proposed RISDM (Requirements Inspection System Design Methodology), a methodology for designing the RIS (Requirements Inspection System).
- ✓ Defined the PQC (Pragmatic Quality Characteristics) and the reading techniques (e.g., Inspection points and Question set) based on PBR(Perspective-Based Reading).
- ✓ Corporate-wide application of the RIS designed by the RISDM demonstrated the improvement of the SRS quality and prediction of the risk of successive development

☐Future Works

- ✓ Plan to analyze of the impact of PQC of SRS to the cost, quality and delivery-time.



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